

Camera Simulator

Fact Sheet

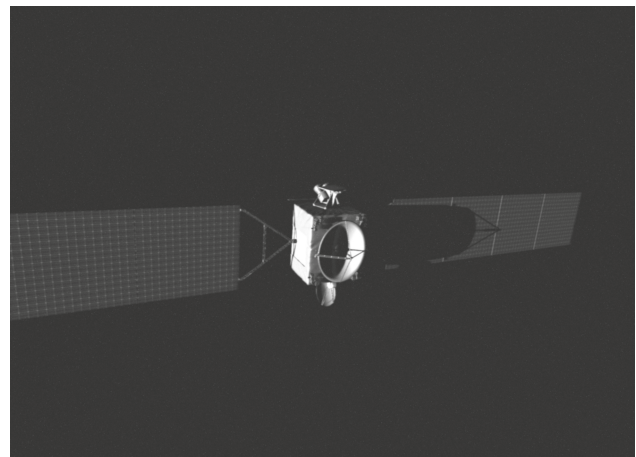


Applications

- Generation of photo-realistic images based on 3D graphics
- Generation of raw depth maps for LIDAR sensor modelling
- Simulation of sensor input in early design phases, when the mechanical design is not yet fixed and satellite mock-up manufacturing is not viable
- Test and development of image processing algorithms and hardware with realistic input data
- Emulation of imaging and LIDAR sensors in real-time closed-loop GNC simulations
- Landing as well as Rendezvous and docking simulators
- Generation of AI training data (including ground truth data)

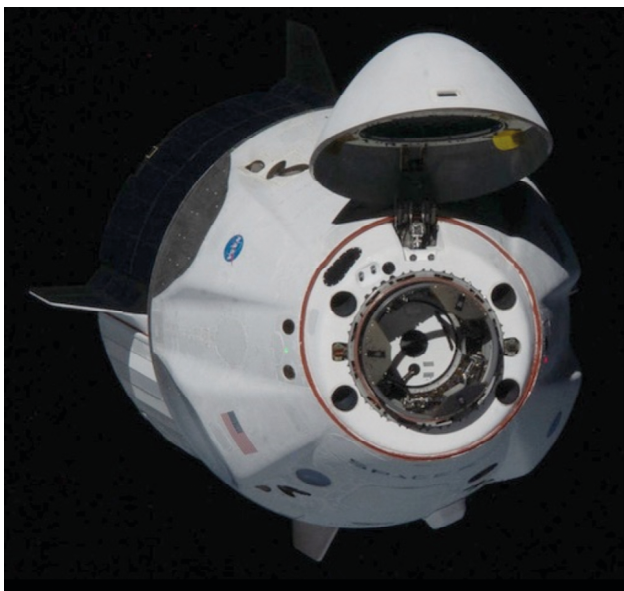
Benefits

- Cost and risk mitigation due to early identification of design errors
- Test of many (virtual) cameras or LIDAR configurations in short time without extra cost
- Easy integration into real-time GNC simulation environments
- Fast generation of hundreds of thousands of AI training data sets



Example images in true color and IR monochrome

Photo of the Dragon capsule on the left and similar scene generated by the camera simulator on the right



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Features

Support for various sensor types

- Monochrome and colour cameras
- NIR to thermal IR cameras
- Scanning and flash LIDAR
- Photo sensors (e.g. sun sensors, solar arrays)

Realistic scenario simulation:

- Surface materials
- Reflections & shadowing
- Atmospheric scattering
- (Irregular) celestial bodies and star catalogue
- Sunlight, albedo & artificial light sources (HDR)

Simulation of camera characteristics

- Depth of field
- Amplifier noise
- Defective pixels
- Wavelength spectrum
- Radial distortion

Scene generation

- Procedural boulder and crater generation with localized size and density distribution
- Bezier mesh refinement for user-provided surface grids
- Artificial multi-layer surface modelling

Meta-data output

- Distance and time information
- Surface normals
- Artificial scene data (e.g. rock locations and size)
- Meta data can be overlaid or is provided via TCP/IP

Run-time controllability

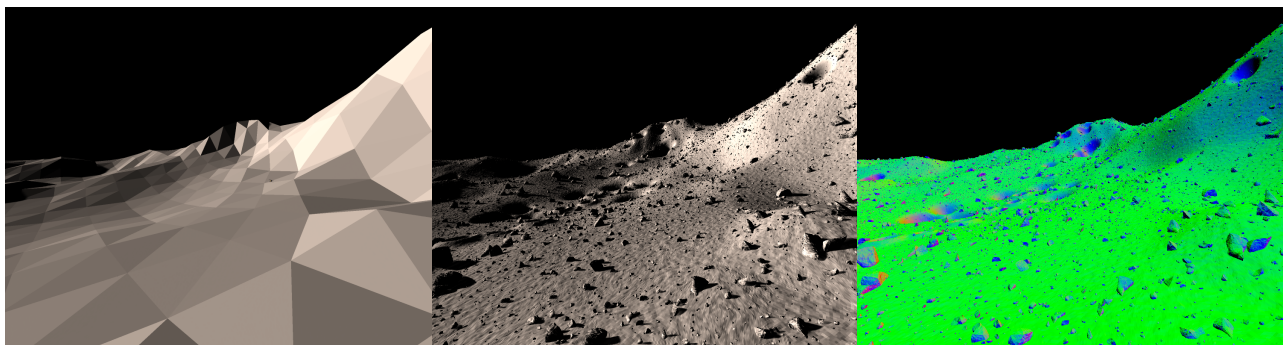
- Physical effects
- Camera characteristics
- Scene generation parameters
- Temperature of thermal nodes

Various operational modes

- Fixed frame rate and triggered image data generation
- Flexible output formats (image/video)
- Trajectory and attitude import as well as real-time trajectory and attitude data interfaces
- Mathworks® Simulink® block for easy interfacing

Multiple vehicles and articulations

- Rendezvous scenarios
- Robotic arm operations
- Movable solar arrays and radiators



Original mesh (left), refined mesh with boulders & craters (middle) and meta data (right; here: surface normals)